

Smoking-Attributable Mortality in Missouri

Cigarette smoking is the chief preventable cause of premature death in the United States. Overall, smoking causes more premature deaths than any other health risk behavior. In Missouri in 1995, it is estimated that over 10,729 deaths, nearly one in five, were hastened by the decedent's smoking.

Death certificates do not include "smoking" as a cause of death. Rather, death certificates list disease conditions, and we know from epidemiological studies that smoking increases the risk of death from certain diseases. The most common are heart disease, lung cancer, and obstructive lung disease. Smoking also contributes to deaths from other cancers (e.g. pancreatic, cervical, bladder, and kidney), low birth weight, and sudden infant death syndrome, and causes some deaths due to fires.¹ We can use our knowledge of the increased risk caused by smoking to estimate the numbers of deaths attributable to smoking.

Of course, not all deaths due to the diseases listed above are due to smoking. Smoking is the cause of a larger proportion of deaths due to some diseases than others. Those proportions, called smoking-attributable fractions, are the basis for estimating smoking-attributable mortality.

In 1986, The Minnesota Department of Health developed microcomputer software for estimating smoking-attributable disease impact and named it SAMMEC (Smoking-Attributable Mortality, Morbidity, and Economic Costs). To assist states in calculating the disease impact of cigarette smoking, the Centers for Disease Control and Prevention (CDC) have further developed SAMMEC and provided it to states in the form of a software program.²

SAMMEC's smoking-attributable fractions are based on relative risk. For a smoking-related cause of death, the relative risk is the ratio of the mortality rate for current or former smokers to the mortality rate for persons who never smoked ("never-smokers"). Relative risks for some of the smoking-related causes of death in SAMMEC 3.0 are shown in Table 1. For example, the first number in the table indicates that men who smoke are 27.5 times more likely to die of oral cancers than are men of the same age who never smoked.

Table 2 shows the results of using CDC's relative risk estimates and Missouri-specific data on smoking prevalence, population and mortality, for 1985, 1990 and 1995 in the current version of SAMMEC. (Estimates of deaths due to burns from smoking-related fires are omitted.)

The changes across time indicated by these numbers reflect changes in overall mortality due to those conditions. Missouri rates of death due to lung cancer, chronic lung disease (COPD), and pneumonia and influenza all increased 1985-1990 and 1990-1995. On the other hand, some death rates due to cardiovascular causes decreased. The atherosclerosis rate halved and the heart disease death rate decreased from 369.3 to 344.7 per 100,000 population. Cerebrovascular (stroke) deaths dipped between 1985 and 1990 but returned part way back up by 1995. Missouri's total infant death rate decreased from 10.2 to 9.4 to 7.4 per 1,000 live births, respectively, for 1985, 1990 and 1995.

There is a sharp difference between the patterns for males and females. For males, the number of estimated smoking-related deaths was two percent higher in 1995 than it was in 1985. For females, the 1995 number was 21 percent higher than 1985's. Generally, women live longer than men, but the longevity gap has been narrowing, primarily because of the growing effect of those for women can be expected to remain high for at least a few more years.

To obtain the numbers in Table 2, Missouri mortality numbers by age were obtained from the death certificate data system. Populations for 1990 were from the US Census, and those for 1985 and 1995 were from intercensal

estimates. For conditions related to maternal smoking during pregnancy, the prevalence data are taken from the Missouri resident birth certificates. Ideally, the smoking rates used to calculate smoking-related disease deaths should reflect smoking behavior twenty to forty years prior to the deaths under study, because those deaths occur after decades of smoking. Actually, smoking prevalence is obtained from a statewide telephone survey (Behavioral Risk Factor Surveillance System, BRFSS) which began in Missouri in the late 1980s. The prevalence data used in creating Table 2 are shown in Table 3.

These numbers show an encouraging downward trend. Also striking is the difference between under-65 and over-65 percentages of current smokers. Apparently many persons either quit smoking or die prior to age 65.

Smoking prevalence data from the BRFSS are based on a sample, and the sample size is not large enough to provide reliable data for small areas, such as Missouri counties. Indeed, the CDC documentation for SAMMEC states that it "will produce unreliable estimates of disease impact if the population is less than a few hundred thousand persons."

To get some idea of patterns within the state, we applied the statewide smoking rates to 1995 mortality and population data for urban and rural areas in Missouri. "Urban" counties are the 22 Missouri counties which include an area defined as a Metropolitan Statistical Area (MSA). Although the same prevalence rates are assumed (probably not true), the program calculated different patterns between the two areas, because of different cause of death patterns, as shown in Table 4.

The rates were adjusted for age to compensate for different age distributions between urban and rural areas. The smoking-attributable death rate is higher in rural areas overall, largely because it is so much higher for males. In non-MSA areas, the rate for females is actually lower than for MSA areas. Although the same prevalence rate was used in the two calculations, the results may reflect sharper gender differences in smoking behavior twenty to forty years ago in the rural areas than in the urban areas.

Another way to obtain estimates of smoking-attributable mortality for small areas is to use an estimation method which does not rely on prevalence data. When numbers and rates of the leading causes of death were calculated by county for the Missouri Department of Health's Internet web site (www.health.state.mo.us), we wished to include data on smoking-related deaths for each county. To do that, we used an approach developed by the Michigan Department of Public Health, based on reports from the Surgeon General on the effects of smoking.⁶

Michigan's estimates are that smoking is the cause of about 80 percent of cancers of the lung, bronchus and trachea, 80 percent of chronic obstructive pulmonary disease (emphysema, asthma, and other obstructive lung disease) and about 30 percent of ischemic heart disease. The Michigan estimates are smaller than SAMMEC's, because they are based on only a subset of the smoking-related causes of death. For example, non-respiratory cancers, cardiovascular disease causes other than ischemic heart disease, and perinatal conditions are not included in the Michigan estimates. For 1995, while SAMMEC estimates that 10,729 of the 54,222 Missouri resident deaths were attributable to smoking, the Michigan method gives an estimate of only 8,812.

Besides being more accurate, the SAMMEC method has the additional advantages that its assumptions are based on more recent data, and that it can be modified as more is learned about the effects of smoking. The SAMMEC software also includes estimates of financial costs of smoking-related death, as well as of illness and medical care. Although the Michigan estimates are probably an undercount, they can provide a useful rule of thumb, especially when estimates for small areas are needed.

Even the SAMMEC estimates, the larger of the two, may be an undercount, however, because they do not include:

- deaths due to passive smoking ("secondhand" smoke)
- deaths due to cigars, pipes and chewing tobacco
- deaths due to causes not related to smoking, but which were hastened by poor health status due to smoking.

Also, all these estimates deal with death only, without regard to persons who die of something else but whose quality of life was reduced by smoking-related respiratory ailments. Regardless of methods of calculation, however, the toll of tobacco use is, in a more important sense, incalculable.

References:

This article is largely based on: Miller, Nancy, M.Ed., CHES, Eduardo J. Simoes, M.D., MPH, Jian Chang, Ph.D., "Smoking-Attributable Mortality in Missouri, 1995," *Missouri Medicine*, November 1997, Vol. 94, No. 11, pp. 661-665. Prevalence and mortality estimates in this article differ slightly because of refinements to the smoking prevalence estimates.

1. McGinnis JM, Foege WH. "Actual causes of death in the US." *JAMA* 1993; 270:2207-2212.
2. Centers for Disease Control and Prevention. *Smoking-attributable mortality, morbidity, and economic costs (SAMMEC 3.0) computer software and documentation-1996*. Office on Smoking and Health.
3. CDC, SAMMEC 3.0, Section II, p 5.
4. "Leading Causes of Death by Gender," *Missouri Monthly Vital Statistics*, Missouri Department of Health, State Center for Health Statistics, November 1995.
5. The standard population used for age-adjusting is the US 1980 population, the SAMMEC default. These rates, therefore, will not be comparable with other rates published by the State Center for Health Statistics, which are adjusted to US 1940.
6. *The Health Consequences of Smoking: Cancer*. U.S. Department of Health and Human Services, 1982.

The Health Consequences of Smoking: Cardiovascular Disease. U.S. Department of Health and Human Services, 1983.

The Health Consequences of Smoking: Chronic Obstructive Lung Disease. U.S. Department of Health and Human Services, 1984.

Table 1

Relative Risk Estimates Attributable to Smoking for Current and Former Smokers
(>35 years of age) Compared with Never Smokers, by Disease Category and Gender

| Cause of Death | Males | | Females | |
|-----------------------------|---------|--------|---------|--------|
| | Current | Former | Current | Former |
| | Smoker | Smoker | Smoker | Smoker |
| Oral Cancer | 27.5 | 8.8 | 5.6 | 2.9 |
| Cancer of Esophagus | 7.6 | 5.8 | 10.3 | 3.2 |
| Cancer of Larynx | 10.5 | 5.2 | 17.8 | 11.9 |
| Lung Cancer | 22.4 | 9.4 | 11.9 | 4.7 |
| Bronchitis/Emphysema | 9.6 | 8.8 | 10.5 | 7.0 |
| COPD* | 9.7 | 8.8 | 10.5 | 7.0 |
| Ischemic Heart Disease <65 | 2.8 | 1.8 | 3.0 | 1.4 |
| Cerebrovascular Disease <65 | 3.7 | 1.4 | 4.8 | 1.4 |
| Atherosclerosis | 4.1 | 2.3 | 3.0 | 1.3 |

*Chronic Obstructive Pulmonary Disease

Table 2

Smoking-Attributable Mortality by Cause of Death and Sex

Missouri Residents: 1985, 1990 and 1995

| | <i>Male</i> | | | <i>Female</i> | | | <i>Total</i> | | |
|----------------------|-------------|-------|-------|---------------|-------|-------|--------------|-------|--------|
| | 1985 | 1990 | 1995 | 1985 | 1990 | 1995 | 1985 | 1990 | 1995 |
| Malignant Neoplasms | 2,318 | 2,497 | 2,558 | 846 | 1,000 | 1,202 | 3,164 | 3,497 | 3,760 |
| Circulatory Diseases | 3,093 | 2,829 | 2,873 | 1,681 | 1,370 | 1,642 | 4,774 | 4,199 | 4,515 |
| Respiratory Diseases | 1,284 | 1,300 | 1,421 | 643 | 764 | 1,010 | 1,927 | 2,064 | 2,431 |
| Perinatal Conditions | 33 | 27 | 13 | 23 | 17 | 10 | 56 | 44 | 23 |
| Total | 6,728 | 6,653 | 6,865 | 3,193 | 3,151 | 3,864 | 9,921 | 9,804 | 10,729 |

Smoking prevalence for 1987 was used in the 1985 calculation, because 1987 is the earliest year available.

Table 3

Smoking Prevalence by Age Group and Sex: Missouri Residents 1987, 1990 and 1995

| <i>1987</i> | | | <i>1990</i> | | | <i>1995</i> |
|---------------|----------------|---------------|----------------|---------------|----------------|---------------|
| <i>Male</i> | <i>Current</i> | <i>Former</i> | <i>Current</i> | <i>Former</i> | <i>Current</i> | <i>Former</i> |
| Age 35-64 | 35.8 | 37.1 | 31.8 | 36.9 | 32.1 | 36.9 |
| Age 65+ | 17.9 | 46.9 | 14.9 | 54.4 | 13.0 | 60.6 |
| <i>Female</i> | | | | | | |
| Age 35-64 | 27.6 | 16.7 | 23.6 | 19.6 | 21.4 | 25.6 |
| Age 65+ | 14.7 | 17.3 | 11.1 | 17.0 | 11.3 | 27.5 |
| Maternal | 29.0* | | 24.7 | | 20.0 | |

*1985 rate

Provisional Vital Statistics for May 1997

Live births decreased in January as 6,134 Missouri babies were born compared with 7,142 in January 1997. The birth rate decreased from 16.1 to 14.2 per 1,000 population during these time periods.

Cumulative births for the 12 months show a slight increase. The 1997 provisional birth total of 73,800 is the highest since 1993.

Deaths decreased in January as 5,252 Missourians died compared with 5,724 one year earlier. For the 12 months ending with January, deaths increased slightly from 54,088 to 54,366.

The **Natural increase** for the 12 months ending with January was 19,207 (73,573 births minus 54,366). The rate of natural increase for this period was 3.6 per 1,000 population compared with 3.5 per 1,000 population one year earlier.

Marriages decreased to the lowest level in thirty years in 1997 (43,600), while **Dissolutions of marriages** decreased to the lowest level in 8 years (25,300).

Infant deaths remained at approximately the same level in 1996 and 1997, 7.6 per 1,000 live births.

PROVISIONAL RESIDENT VITAL STATISTICS FOR THE STATE OF MISSOURI

| | <u>January</u> | | <u>12 months ending with January</u> | | |
|-------------|----------------|------|--------------------------------------|------|---------------------|
| <u>Item</u> | Number | Rate | Number | Rate | Provisional 1997 |

| | <u>1997</u> | <u>1998</u> | <u>1997</u> | <u>1998</u> | <u>1996</u> | <u>1997</u> | <u>1998</u> | <u>1995</u> | <u>1996</u> | <u>1997</u> | <u>1998</u> | <u>Number</u> | <u>Rate</u> |
|---------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|-------------|
| Live Births | 7,142 | 6,134 | 16.1 | 14.2 | 73,486 | 72,722 | 73,573 | 14.1 | 13.8 | 13.5 | 13.6 | 73,800 | 13.7 |
| Deaths | 5,724 | 5,252 | 12.9 | 12.2 | 54,195 | 54,088 | 54,366 | 10.0 | 10.2 | 10.1 | 10.1 | 54,100 | 10.0 |
| Natural increase | 1,418 | 882 | 3.2 | 2.0 | 19,291 | 18,634 | 19,207 | 4.2 | 3.6 | 3.5 | 3.6 | 19,700 | 3.6 |
| Marriages | 2,657 | 2,379 | 6.0 | 5.5 | 44,870 | 45,402 | 43,307 | 8.5 | 8.4 | 8.5 | 8.0 | 43,600 | 8.1 |
| Dissolutions | 1,774 | 2,181 | 4.0 | 5.0 | 26,683 | 25,319 | 25,664 | 5.0 | 4.8 | 4.7 | 4.7 | 25,300 | 4.7 |
| Infant deaths | 51 | 57 | 7.1 | 9.3 | 534 | 578 | 574 | 8.0 | 7.3 | 7.9 | 7.8 | 560 | 7.6 |
| Population base (in thousands) | ... | ... | 5,402 | 5,440 | ... | ... | ... | 5,325 | 5,364 | 5,402 | 5,440 | ... | 5,402 |

*Rates for live births, deaths, natural increase, marriages and dissolutions are computed on the number per 1000 estimated population. The infant death rate is based on the number of infant deaths per 1000 live births. Rates are adjusted to account for varying lengths of monthly reporting periods.

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